HIM SPHURTI
(CSIR-IHBT-T-01)
A cultivar of china hybrid tea
(*Camellia sinensis*)

The cultivar Him Sphurti (CSIR-IHBT-T-01; Kangra selection CEF-02) of china hybrid tea (*Camellia sinensis*) has been developed by CSIR-Institute of Himalayan Bioresource Technology through selection approach. The cultivar was selected as early flusher from the century old heterozygous china hybrid seed *Jat* in the Kangra valley.

The cultivar has excellent nursery performance both in rooting and early establishment. It is vigorous in growth and has wide adaptability. It recorded over 1,500 kg made tea/ha yield (4-year cycle average) which was 50 to 80 % higher than the recommended cultivars in this region. The cultivar has a potential of yielding 2500 kg made tea/ ha after first pruning cycle.

Made tea yield (kg/ha) of Him Sphurti (CEF-02) in comparison to recommended tea cultivars

Clone/Selection	2008	2009	2010	2011	Mean	% Over K-Asha
CEF-02 (Him Sphurti)	1384	1544	1420	2396	1686	182
Kangra Asha	491	351	544	2319	926	100
UPASI-9	1091	1233	1377	1860	1390	150
SEm±	61	65	55	72	45	-
LSD	184	197	166	217	136	-

Morphological features of Him Sphurti (CEF-02) in comparison to recommended cultivars

Cultivars / Clones	Leaf size (cm)		Internode length (cm)	Leaf shape
	Leaf length	Leaf width		
CEF-02	7.4	2.8	2.2	Wavy
Kangra Asha	5.3	2.8	2.9	Down turned
Kangra *Jat*	5.2	1.9	1.8	Down turned
UPASI-9	10.3	3.9	3.3	Down turned

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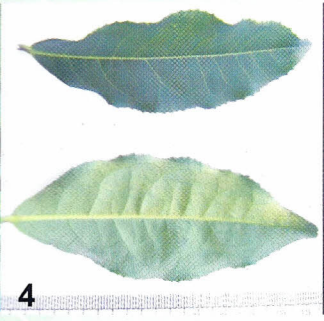
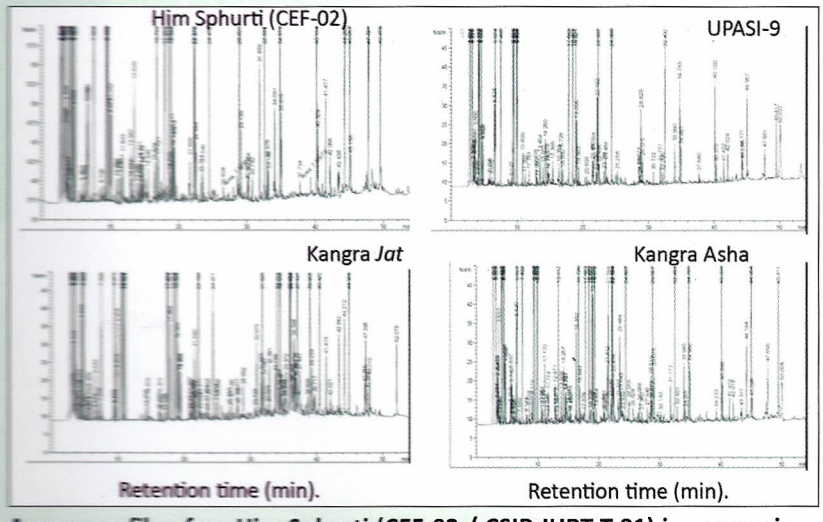
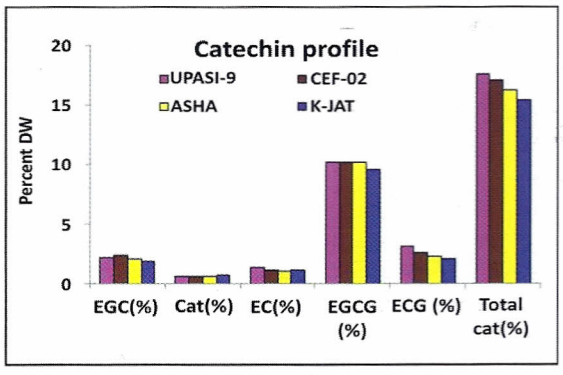


The cv. Him Sphurti (CSIR-IHBT-T-01/CEF-02) exhibiting (1) recovery after pruning, (2) mature bushes, (3) shoot regeneration, (4) mature leaf - dark in colour with wavy margins, and (5) flowers



Aroma profile of cv. Him Sphurti (CEF-02 / CSIR-IHBT-T-01) in comparison to UPASI-9, Kangra *Jat* and Kangra Asha



Clone	Theaflavins (% DW)	Thearubigins (% DW)	Caffeine (% DW)
UPASI-9	0.468	7.46	2.31
CEF-02	0.428	7.16	2.14
ASHA	0.424	7.12	2.68
Kangra *Jat*	0.416	7.04	2.58

Catechin profile and infusion parameters of cv. Him Sphurti (CEF-02 / CSIR-IHBT-T-01) in comparison to UPASI-9, Kangra *Jat* and Kangra Asha

Quality parameter		Remarks
Aroma	Aroma GC profile	Better than Kangra Asha, Kangra *Jat* and UPASI-9
Astringency	(TF, TR, Caffeine)	At par with Kangra Asha, UPASI-9, better than Kangra *Jat*
Brightness	(TF)	At par with Kangra *Jat*, Kangra Asha, lower than UPASI-9
Briskness	(TF, TR, caffeine)	At par with Kangra Asha, UPASI-9 better than Kangra *Jat*

Overall quality of cv. Him Sphurti (CEF-02/ CSIR-IHBT-T-01) in comparison to UPASI-9, Kangra *Jat* and Kangra Asha

The cultivar CSIR-IHBT-T-01 is semi-arboreal and free growing bush attains height of 3 m. It is early flushing china hybrid type, with multiple branched, erect and upright stem. Leaf large (l/b of fifth leaf of fresh shoot = 7.4 cm / 2.8 cm), dark, green, matt, non-lustrous, lanceolate, smooth,

with intermediate pubescence, and turns wavy when mature. Flower white, borne on axils solitary or in clusters. This clone is moderately resistant to blister blight (10-20 % disease severity).

The cultivar contains high levels of total catechins (17.2 %). It is suitable for making orthodox black and green teas. The aroma of orthodox tea made from the clone showed high top floral with roast notes distinctive of Kangra orthodox tea. The infusion is bright, astringent and flavoury.

Planting and rearing: The cultivar should be planted as a single hedge row with planting distance of 105 cm row to row and 60 cm plant to plant keeping the lines along the contour with provision of drainage and shade trees, using standard practices of new planting or replanting. Irrigation is required particularly in summer period after planting and during young stage for better establishment of the plant. Young plants should be thumb pruned/ decentred in the first year, recentred and cut across in the second year. Frame formation prunes to be given in the third and fourth years. Thereafter it will come to regular bearing. Fertilizer (YTD) dose should be applied in the ratio of 2:1:3 of N, P and K at the rate of 20, 40, 60 and 80 kg nitrogen/ha in the first, second, third and fourth year, respectively, in three splits at monthly intervals. Mulching in the young tea stage helps in weed management and soil moisture conservation.

Pruning cycle: A 4-year pruning cycle `LP-LoS-DS-LoS' (i.e. every year prune 25 %, deep-skiff 25 % and level of skiff / unprune 50 % of the tea garden) has been found better for the region both in terms of quality and yield. Since, it is a vigorous cultivar with early flushing character, efforts should be made to get maximum crop during the first flush by opting for summer pruning provided suitable weather conditions prevail.

Manuring: The general recommendation of fertilizer dose for tea plantations of Himachal Pradesh is 120:90:90:: $N:P_2O_5:K_2O$ kg/ ha. During pruned year, the potash application may be raised to 120 kg/ha keeping in view its requirement for frame formation. For specific recommendations of the fertilizers, soil should be tested for the available nutrient status. Efforts should be made to keep potash at high level. The fertilizers after thorough mixing should be applied before the onset of plucking season i.e. in the beginning of the February month after rain so that there is sufficient soil moisture. In pruned sections, the fertilizer should be applied when the bushes attain sufficient foliage. In young stage, where the ground coverage is not complete, apply the fertilizer mixture in a broad ring corresponding to the periphery of the bush frame. In mature tea, broadcast the fertilizers uniformly all over the ground, avoiding the dumping or heaping of the fertilizers inside the bush frame or at the collar level. Splitting of fertilizer dose particularly N in 2 splits, first split in the month of February and second before onset of the monsoon would improve fertilizer use efficiency. Foliar application with 3 rounds of Urea 2 %, Zinc 2 %, and Magnesium 1 % is helpful in improving size of shoots and crop yield. Similarly foliar spray of these nutrients along with potash 2 % at weekly interval after plucking helps to combat drought condition.

Plucking management: For quality crop, it is essential that plucking standard should be fine. Plucking interval should be kept between 5-8 days depending on the rate of shoot growth. A minimum of 60 % fine crop should be targeted. Stripping of shoots and longer plucking interval should be avoided. In case of labour shortage, black plucking may be adopted to extend the plucking interval.

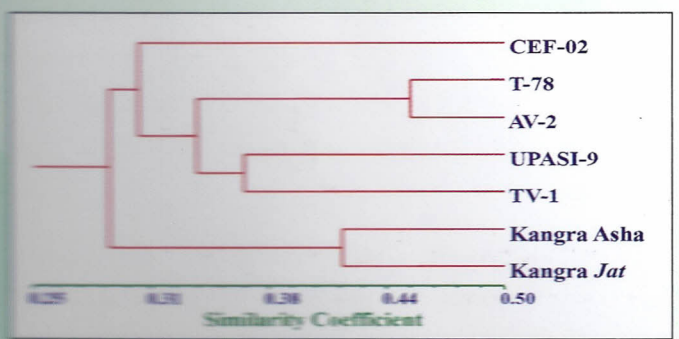
Pest management: Though no serious pest attack has been recorded in the experimental plots, yet it is important to keep a vigil on the plantations, particularly for the mealy bug and blister blight, which pose serious threat in this region. Standard

practices for weed management as well as insect-pests and blister blight disease may be adopted.

Molecular profiling : With an aim to develop DNA fingerprints of the cultivar Him Sphurti (CSIR-IHBT-T-01; CEF-02), six counter-part cultivars *viz.*, Kangra Asha, Kangra *Jat* from Kangra, T-78, AV-2 from Darjeeling, TV-1 from Assam and UPASI-9 from south India were included for comparison.

Marker	CEF-02	Kangra Asha	Kangra Jat	T-78	AV-2	UPASI9	TV1
TUGMS3 12_220		■				■	
TUGMS3 12_210						■	
TUGMS3 13_320			■				
TUGMS3-14_400					■		
TUGMS3-14_385						■	
TUGMS3-19A_215	■				■		
TUGMS3-19B_250				■		■	
TUGMS3-19B_230					■		
TUGMS3-19B_225		■					
TUGMS3-22_265	■	■					
TUGMS3-22_245				■	■		
TUGMS3-22_235				■			
TUGMS3-22_225			■				
TUGMS3-24_400	■	■					
TUGMS3-6_340	■						
TEIGMS 127_380		■					
TEIGMS 127_370	■					■	■
TEIGMS 132_330		■					
TEIGMS 132_325					■		
TEIGMS 132_300		■					
TEIGMS 132_290						■	
TEIGMS 132_280	■						
TEIGMS 134_200					■		
TEIGMS 134_180	■						■
TEIGMS 134_170	■						
OP-26-03_1400					■		
OP-26-03_550			■				
OP26-05_1700		■					
OP-26-12_1000							■
OP-26-13_900					■		
OP-26-14_500				■			
OP-26-14_1100			■				
OP-26-14_500		■					
OPM-6_2000					■		■
OPM-6_1200			■				
OP-26-18_1500	■			■	■		
OP-26-18_900							
OP-26-24_1900		■					
OPC-13_1400						■	

Diagrammatic representation of DNA fingerprints of Him Sphurti (CEF-02) and popular six tea clones



Dendrogram showing genetic similarity of Him Sphurti (CEF-02) and six released tea clones made based on combined SSR and RAPD data

Twenty three polymorphic primers (13 SSR and 10 RAPD) evincing reproducible polymorphic loci between the cultivar were used for development of fingerprints. A total of 109 polymorphic loci were amplified. Of these, 105 were found to be polymorphic with very high rate of polymorphism (overall 96 %). Based on the SSR and RAPD data, consolidated DNA fingerprints were developed with rare or unique 84 loci which could give the close picture and details of minimum number of markers utilized for identification of these clones. Cluster analysis of these cultivars based on 105 polymorphic loci grouped all the clones in two major groups. CSIR-IHBT-T-01 has revealed pair-wise maximum GS with TV-1 (33 %) followed by Darjeeling clones AV-2 and T-78 (32 %). In conclusion, genetic similarity data based on 105 polymorphic loci suggested that the cultivar Him Sphurti (CEF-02) has captured moderate to high level of genetic diversity.

Contributors

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